Customer No.: 31561
Application No.: 10/711,678
Docket No.: 13605-US-PA

REMARKS

Present Status of the Application

Claims 1-7 and 13-19 are rejected under 35 U.S.C. 103(a), as being unpatentable over Nishizawa (U.S. 6613686). Further, claims 8-12 are rejected under 35 U.S.C. 103(a), as being unpatentable over Nishizawa and in view of Autryve (US 5935877). Applicants have amended claims 1, 5 and 11, canceled claims 4 and 12, and added new claims 20-22. After entry of the foregoing amendments, claims 1-3, 5-11 and 13-22 remain pending in the present application, and reconsideration of those claims is respectfully requested.

Discussion of Office Action Rejections

The Office Action rejected claims 1-7 and 13-19 under 35 U.S.C. 103(a), as being unpatentable over Nishizawa (U.S. 6613686). Claims 8-12 are rejected under 35 U.S.C. 103(a), as being unpatentable over Nishizawa and in view of Autryve (US 5935877).

Applicants respectfully traverse the rejections for at least the reasons set forth below. The present invention is directed to patterning method for reducing the condense defect when the patterned photoresist layer is etched at low temperature. The amended claim 1 reads:

Claim 1 (Currently amended) A patterning method, comprising:

providing a substrate having a film formed over thereon;

forming a photoresist layer over the film;

exposing and developing the photoresist layer to form a patterned photoresist layer; and

etching the film by performing an anisotropic plasma etching process with a power applied at one electrode in a range of about 150W to about 300W for generating a field using the patterned photoresist layer as an etching mask at a temperature range of about –50℃ to about 50℃.

Applicants respectfully assert that Nishizawa is legally deficient for the purpose of rendering claim 1 unpatentable for at least the reason that not every element of the claim was taught or suggested by cited references such that the invention as a whole would have been obvious to one of ordinary skill in the art.

The present invention specifically teaches "etching the film by performing an anisotropic plasma etching process with a power applied at one electrode in a range of about 150W to about 300W for generating a field" as taught in claim 1.

The technical significant of the foregoing limitations is that the anisotropic plasma etching process includes a power applied at one electrode in a range of about 150W to about 300W for generating a field. The power brings high bombardment ions and thereby the condense defect owing to etching the patterned photoresist layer at low temperature can be removed.

Nishizawa, on the other hand, provides a method of etching silicon nitride film and method of producing semiconductor device. The object of the Nishizawa is to provide an etching method that restrains the formation of copper fluorides when removing a stopper film comprising a silicon nitride film formed on copper interconnects. Nishizawa, simply teaches that the silicon nitride film located on copper is dry etched using a mixture of fluorocarbon gas and an inert gas as the reaction gas, in which the fluorocarbon gas contains both CF_4 and CHF_3 supplied at flow rates in a ratio of 3:7 to 0:1 or contains CF_4 and CH_2F_2 supplied at flow rates in a ratio of

2.5:1 to 0:1. Nishizawa never mentions or teaches that the anisotropic plasma etching process includes a power applied at one electrode in a range of about 150W to about 300W for generating a field to overcome the condense defect.

Autryve provides a plasma process for an insulating layer, such as silicon dioxide, overlaying a silicon surface. Autryve mentions that the power level of the plasma may vary from about 300 W to about 5KW (see col. 7, line 12-39), rather than about 150W to about 300W of the claimed invention.

The objects of Nishizawa and Autryve are different from that of the present invention, therefore there is no motivation for people skilled in the art to combine Nishizawa and Autryve to solve the problem of condense defect when the patterned photoresist layer is etched at low temperature. Furthermore, in Autryve, since the power level of the plasma is from about 300 W to about 5KW, Nishizawa in view of Autryve also fails to teach or suggest the claimed invention, that is "etching the film by performing an anisotropic plasma etching process with a power applied at one electrode in a range of about 150W to about 300W for generating a field" as taught in claim 1.

In light of the amendment and the foregoing discussion, claim 1 is not anticipated by prior art and are believed to be patentably distinguished from the cited art so that the reconsideration and withdrawal of the Office Action's rejection to claim 1 under 35 U.S.C § 103 are respectfully requested.

Dependent claims 2-3, 5-11 and 13-19 are submitted to be patentably distinguishable over the prior art of record for at least the same reasons as independent claim 1 from which these claims respectively depend, as well as for the additional features that these claims recite. Accordingly, Applicants request that the Section 103 (a) rejection to claims 1-3, 5-11 and 13-19 be withdrawn.

Discussion of new added claims 20-22

Applicants added new claims 20-22. The added claim 20 reads:

Claim 20 (New added) A patterning method, comprising:

providing a substrate having a film formed over thereon;

forming a photoresist layer over the film;

exposing and developing the photoresist layer to form a patterned photoresist layer; and

using the patterned photoresist layer as an etching mask, etching the film by performing an anisotropic plasma etching process using a plasma sources containing a perfluorinated chemical and a partially fluorinated chemical supplied at a gas flow ratio of larger than 1 at a temperature range of about –50 ℃ to about 50 ℃.

The technical significant of the foregoing limitations is that the film is etched by performing an anisotropic plasma etching process using a plasma sources containing a perfluorinated chemical and a partially fluorinated chemical supplied at a gas flow ratio of ***larger than 1*** at a temperature range of about –50°C to about 50°C. If the proportion of the partially fluorinated chemical is too high, the etching process will produce more polymer defect.

Therefore, the lower the proportion of the partially fluorinated chemical and the higher of the perfluorinated chemical can prevent the production of the polymer defect.

Nishizawa, on the other hand, teaches that the silicon nitride film located on copper is dry etched using a mixture of fluorocarbon gas and an inert gas as the reaction gas, in which the fluorocarbon gas contains both CF_4 and CHF_3 supplied at flow rates in a ratio of 3:7 to 0:1 or contains CF_4 and CH_2F_2 supplied at flow rates in a ratio of 2.5:1 to 0:1. If the flow rate of CF_4 to CHF_3 is more than 3:7, the amount of the unwanted copper fluoride is large (see Table 1, Experiments No. 1 and 2). Therefore, Nishizawa teaches away the claimed invention and there is no motivation for the people skilled in the art to modify Nishizawa to obtain the claimed invention.

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CONCLUSION

For at least the foregoing reasons, it is believed that the pending claims 1-3, 5-11 and 13-22 are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

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Respectfully submitted,

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